Spring 2009

Chemistry & Biochemistry Newsletter

Department of Chemistry & Biochemistry, South Dakota State University

In 2010, the Avera Health and Science Center will be the new home of SDSU's Department of Chemistry and Biochemistry.

Inside

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South Dakota State University

Chemistry & Biochemistry

Spring 2009

Greetings from the Department!

The 2008/2009 academic year flew by in a whirlwind but looking back it is the number of things we accomplished to continue to grow our programs that is amazing. It is a tribute to the faculty and staff who have invested so much of themselves in serving our students and the state of South Dakota.

The CLS program continues its evolution towards NAACLS-accredited status. Deb Pravecek oversaw the hiring of two additional faculty for the CLS program on new FTEs, a real institutional commitment to the program in a difficult economic climate. The program is now fully staffed. Deb also oversaw the hiring of her replacement because she is retiring at the end of June (p. 5). She has made tremendous contributions to the CLS program, SDSU and South Dakota. She was a wonderful colleague and while we will miss her, we all wish her the best as she starts on this new path. Her replacement, Dr. Pat Tille, started in May and has hit the ground running since we are anticipating the NAACLS site visit in about a year. Our fall newsletter will introduce you to all three of these new faculty members.

The construction of the addition to the Shepard Hall facility and the renovation of new Shepard Hall have finally kicked into high gear (p. 3). We occupied the third floor of the renovated Shepard Hall the week of June 22. Its occupants will be the biochemistry and organic faculty and their research groups that have recently organized themselves into the Center for Biological Control and Analysis by Applied Photonics (BCAAP). (You can learn more about BCAAP on p. 7 because they were recently informed that they will receive at $4.3 million, five-year 2010 Research Center grant beginning on July 1, 2009.) The renovation of the second floor of New Shepard Hall will start by the end of June and we hope to occupy it by spring break (early March, 2010). We are still scheduled to occupy the new building in June 2010, but with the rate at which they are making progress on it you just never know!

The newsletter also highlights some of the accomplishments of the Department's graduate and undergraduate students (p. 2, 4-6). They are a talented group of young scientists whose recognitions reflect the commitment that the department's faculty have to graduate AND undergraduate education, and the commitment of the department's staff to supporting those endeavors.

Enjoy the summer! Stay in touch!

Two Majors win Schultz-Werth Awards

Dobberpuhl

Dobberpuhl

Christopher Johnson, a biochemistry major, and Mitchell Dobberpuhl, a chemistry major, were two of ten students to receive Schultz-Werth Awards for their research papers at State.

The awards were established by State alumni Theodore W. Schultz and his wife, Esther Werth Schulz, who maintained the philosophy that the world's most important economic resource is the acquired abilities of people.

The Schultz-Werth Awards are given to senior undergraduate students who submit papers that demonstrate outstanding scholarship through creativity and research. Papers are judged by a faculty committee and are awarded up to $2,500 each for originality, creativity and scholarship.

Johnson, a 2005 graduate of Marshall Senior High School in Marshall, Minn., was awarded $2,500 for his paper titled "Density Function Theory as a Guide for the Design of Dye for Dye-sensitized Solar Cells."

"Dye-sensitized solar cells have been undergoing research as a possible alternative to current silicon-based solar cells, which are expensive to produce," said Johnson. "The highest-efficiency dyes thus far have been ruthenium based; however,ruthenium is rare enough that it would be costly to mass produce these dyes, and there are environmental concerns about the use of heavy metals. As a result, there have been attempts to produce efficient dyes without heavy metals. We examined several derivatives of one such dye, DCM, via DFT and hybrid calculations, with the goal of identifying modifications which would improve its efficiency as aprelude to synthesis."

At SDSU he has received the Dobberstein Undergraduate Research Award, Elaine and Oscar Olson Scholarship, South Dakota EPSCoR internship, and a NASA South Dakota Space Consortium stipend.

Johnson has been accepted to the Roswell Park Cancer Institute in Buffalo, N.Y., where he will pursue a doctorate in biophysics and biochemistry. His research focus will be on developing cancer treatments that will be less damaging to the people who need them.

"I will likely either pursue a career in academia or as a researcher in the medical industry, whichever offers the best opportunity to further my research," Johnson said. "If I can succeed in creating a treatment that deals with cancer without harming those who receive it, I will have met my goal."

Mitchell Dobberpuhl, a 2005 graduate of Sioux Falls Roosevelt High School, was awarded $1,800 for his paper titled "Analysis of a Sulfur Mustard Metabolite from ProteinMatrices using Solid-phase Microextraction and Gaschromatography Mass-spectrometry."

"Current methods for the detection of sulfur mustard, a chemical warfare agent, suffer from issues including lack of sensitivity and the fact that detection must occur soon after exposure before detection will be impossible," Dobberpuhl summarizes."The detection of thiodiglycol (TDG) is necessary as the body metabolizes sulfur mustard to TDG rapidly. As a result, the detection of sulfur mustard is useless if performed after metabolism has occurred. The use of solid-phase microextraction as a method of analysis for TDG shoed a substantial increase in sensitivity compared to the more common method of direct injection analysis."

Dobberpuhl will attend the Sanford School of Medicine in fall 2009 where he plans to pursue a career as a primary care physician in South Dakota."My goals as a physician include providing thorough, quality care for all my patients, extending health services to those lacking substantial care, and adding to the current understanding of medicine through clinical and laboratory research."

Raynie Gives Earth Day Talk

Doug Raynie, Research Associate Professor, presented the keynote address at an Earth Day event in Gilbert Science Centerat on the campus of Augustana College on April 22. He presented some of his thoughts (and opinions) on green chemistry and sustainability and also present some of Julee Driver's work on evaluating the greenness of a chemical process.

Logue Work Recognized

The College of Arts and Sciences recognized Brian Logue, Research Associate Professor of chemistry and biochemistry, as its 2008/2009 outstanding research scientist for his continued research work in detecting biological warfare agents. He is also involved in investigating solar energy use through dye-sensitized solar cells.

Building Groundbreaking and Update

Architect's reneding of the finished Avera Health & Science Center.

After much underground preparation and pouring of concrete for the foundation, January saw work begin above ground.

With construction noise filling the air, leaders of Avera Health and SDSU stood in the foreground April 30, officially celebrating the partnership that is making the Avera Health and Science Center possible.

Home to Chemistry and Biochemistry as well as Pharmacy, work began last spring without a traditional groundbreaking ceremony for a complex that carries a price tag of $51 million. When it's all done, the center will occupy 144,600 square feet, making it the largest academic facilities project in South Dakota history.

Gil Haugan Construction, of Sioux Falls, has been on site since June 2008. Heading into July 2009, the skeletal frame of the new structure is in place along with installation of floor decking and erection of steel studs for exterior and interior walls.

"This is one of our larger jobs," said Gil Haugan Project Coordinator Nick Hofer of the imposing structure. "In our company's fifty-year history, this project ranks right up there."

In February lots of steel beams could be seen above the foundation.

In March the steel skeleton suggested just how large the building is going to be.

The exterior of the north addition is complete.

By April the floors were in place and the exterior walls were starting to be erected.

Nagyvary is Lardy Lecture Speaker

What makes Stradivarius violins made in 17th and 18th century Cremona, Italy, produce some of the most prized sound during the 21st century? Dr. Joseph Nagyvary, professor emeritus at Texas A&M University and owner of Nagyvary Violins, tried to answer to this question at the 17th Henry A. Lardy Lecture Series in Chemistry in March.

During 30 years of research into materials and mechanics of violins, Nagyvary determined that the brilliance and purity of tone come not so much from the design or even the wood itself, but from an elaborate process of chemically manipulating the preparation and finish of the instruments.

A native of Hungary, Nagyvary received his Ph.D. in the chemistry of natural products. During his doctoral work in Zurich, Switzerland, Nagyvary took his first formal violin lessons on an instrument that once belonged to Albert Einstein.

The bond was formed between the noted Nobel physicist and Nagyvary's work with the chemical composition needed to produce fine violins. Now retired from teaching biochemistry and biophysics at Texas A&M, Nagyvary has written numerous articles and delivered over 255 lectures about his effort to solve an age-old violin puzzle.

He also owns a company that manufactures and sells violins made under strict guidelines of chemistry and craftsmanship.

Nagyvary's visit to SDSU began on March 17 with excerpts from Mendelssohn's "Violin Concerto in E Minor" played by SDSU Civic Symphony conductor John Brawand in Peterson Recital Hall. Following a reception, Nagyvary delivered a lecture titled, "Raiders of the Lost Secret: Modern Science and the Holy Grail of the Stradivarius Violin."

The following day Nagyvary delivered a more technical lecture entitled "Recent Progress in the Decoding of the Stradivarius." As the chief researcher behind the chemical-material paradigm, his lecture emphasized the chemical processing of wood used to manufacture violins along with discussion of wood fillers and varnishes used in the process.

Tanaka Undergraduate Award

Michael Collins is working on a project entitled "Carbonic Acid Hydrolysis ofCellulosic Biomass" in Dr. Raynie's lab. He will investigate the effects of time, temperature, pressure, and concentration on the use of carbon dioxide + water mixtures on the hydrolysis of cellulose from prairie cord grass. He will also gain familiarity with supercritical fluid extraction instrumentation, LC determination of sugars, and enzymatic saccharification. He will complete this project near the end of the Fall 2009 semester.

Grad Student joins Young Chemists in Cancer Research Committee

The American Association for Cancer Research invited SDSU graduate student Ethel Ngen to serve on the association's Young Chemists in Cancer Research committee. She began her two-year term in April. Ms. Ngen works under the direction of Dr. Younjae You.

Ngen works with the committee to increase chemistry involvement in the fight against cancer and to motivate the next generation of chemists to join the cause.

"Right now, the emphasis is placed mainly on biology's role in the fight against cancer," said Ngen."We're hoping to re-emphasize the pivotal role of chemistry at the interface of cancer biology."

Originally from Cameroon, West Africa, Ngen received a bachelor's degree in general chemistry and material science technology from the University of Buea, and earned her master's at the University of Douala in inorganic and environmental chemistry.

Ngen worked as a chemist for Exxon Mobil before coming to SDSU in 2006, where she is currently pusuing a Ph.D. in organic chemistry. After graduating, she plans to work in cancer research under the supervision of Dr. You who teaches and researches organic and medicinal chemistry.

Pravecek retires from Clinical Laboratory Teaching

Deb Pravecek, program director of the clinical and laboratory science, will retire after 35 years of service to SDSU.

Pravecek began working for SDSU in 1974 as a research assistant in the laboratories of noted chemistry professor Ivan Palmer where she studied the antioxidant role of the chemical element selenium. She also analyzed biological and geological samples for selenium content.

During her time at SDSU, Pravecek worked to completely restructure the clinical laboratory science program. The program is currently in the process of obtaining national accreditation. She also managed the clinical laboratory in student health services for a number of years and coordinated labs for chemistry instruction.

"Professor Pravecek has been instrumental in developing the clinical lab science major," said Jerry Jorgensen, dean of the College of Arts and Sciences."Without her expertise and knowledge of the clinical lab science field and the accreditation standards, this never would have been possible." Most recently, Praveck served as the program director of the clinical and laboratory science major by teaching courses, coordinating labs and advising students.

"Deb has made tremendous contributions," said Jim Rice, her department head. "We will miss her, but wish her the best as she starts this new phase of her life."

Pravecek graduated from Mount Marty College with a B.S. in chemistry and medical technology. She earned an M.S. in chemistry at SDSU and is a member of the American Society for Clinical Laboratory Science that named her the 2007 Member of the Year for the state society.

Deb Pravecek will retire after 35 years at SDSU. She plans to move to a house she and her husband are building in the Freeman area.

"I have had the privilege of working with many outstanding scientists and educators during my time at this institution," said Pravecek. "I have seen major changes and truly believe great things are in store for SDSU."

Chem Grad Student Selected for National Conference

SDSU grad student Bethany Melroe, Gwinner, N.D., participated in the Chemical Education Research Graduate Student Conference at Miami University in Oxford, Ohio, June 5-7. Ms. Melroe works under the direction of Dr. David Cartrette.

"My advisor strongly recommended applying for this opportunity, as this is the future of chemical education research," said Melroe. She plans to teach in a college setting and continue with research after graduate work.

The conference included two plenary sessions on problem solving and activity-based instruction and offered workshops on writing proposals, submitting research articles and interactive assessment development.

Students had the opportunity to display their current research in two poster sessions. Melroe's research involves an age-comparative study of students and their conceptual understanding while examining ideas in the laboratory.

Melroe took away valuable information from the workshops and learned more about current research being done across the country. She was also excited about the networking opportunities.

Melroe graduated from SDSU in 2005 with a B.S. in chemistry and is currently pursuing her Ph.D. in chemistry. She teaches chemistry laboratories on campus, at the University Center in Sioux Falls and online.

2008-2009 Chemistry and Biochemistry Graduates

Doctor of Philosophy

Jia Lin, Modification, characterization, and applicaiton of N-(R)-succinamic acid modified chitosan. (Dr. Ron Utecht)

Brent Ristow, Photochemistry of N-butyl-4-butylamino-1, 8-naphthalimide and Its Behavior in a Biological Environment. (Dr. Ron Utecht)

Marla Williams, Change in Student Conceptual and Technological Knowledge as a Result of the General Chemistry Laboratory Experience. (Dr. Matthew Miller)

Patrick Youso, Improving the Bioavailability of Topically Applied Ophthalmic Drugs. (Dr. Ron Utecht)

Masters of Science

Jessica Goerdt, Investigation of Dissolved Organic Nitrogen in Water From a Prairie Pothole in Eastern South Dakota. (Dr. James Rice)

Ildiko McClockey, Investigation and Characterization of Clay Mineral-Natural Organic Matter Complexes Using Light Scattering Techniques. (Dr. James Rice)

Bethany Melroe, Effects of Chitosan on the Efficacy of pH Indicating Dye. (Dr. Ron Utecht)

Srinath Pashikanti, Histone HI Studies: 1) In Vivo Evidence of Nuclear Protein Damage, 2) In Vitro Studies of Natural Product Glycation Inhibitors. (Dr. Daniel Cervantes-Laurean)

Bachelor of Science – Chemistry

Derek Brandis (B.S. Chem, May '09), Major in Chemistry, Minor in Mathematics. *(Attending Graduate School at SDSU)*

Catherine Coursen (B.S. Chem, May '09), Major in Chemistry. *(Working for Cook Inlet Environmental Co., Alaska)*

Mitchell Dobberpuhl (B.S. Chem, May '09), Major in Chemistry, Minor in Biology. *(Attending University of South Dakota Medical School)*

Kathryn Engle (B.S. Biochem, May '09), Major in Chemistry, ACS Certified. *(Attending Graduate School at SDSU)*

Sherif Halaweish (B.S. Chem, December '08), Major in Biochemistry. *(Accepted at M.D./Ph.D. program at Case Western Reserve School of Medicine, Cleveland, OH)*

Ellen Hansen (B.S. Chem, May '09), Major in Chemistry, specialization Education. *(Teaching High School Chemistry)*

Amanda Heeren (B.S. Chem, May '09), Major in Chemistry, Minor in Biology. *(Attending Graduate School at Marshall University, Huntington, WV)*

Jordan Hout (B.S. Chem, May '09), Major in Chemistry. *(Teaching High School Chemistry)*

Christopher Johnson (B.S. Biochem, May '09), Major in Chemistry, ACS Certified. *(Attending Graduate School at University of Buffalo, Cancer Institute, Buffalo, NY)*

Diana Miulleryte (B.S. Biochem, May '09), Major in Chemistry and Biology, Minor in German. *(Undecided)*

Kalli Odegaard (B.S. Chem, May '09), Major in Chemistry. *(Seeking Industrial Employment in Birmingham, AL)*

Laura Sanborn (B.S. Chem, May '09), Major in Chemistry, Minor in Biology. *(Pursuing an Industrial Career)*

Jacob Swanson (B.S. Chem, December '08), Major in Chemistry, Minor in Biology. *(Unknown)*

Lucas Zimney (B.S. Chem, May '09), Major in Chemistry, Minor Spanish. *(Attending Graduate School at New Mexico State University)*

Bachelor of Science – CLS

Jonathan Berndt (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology.

Shelby Bush (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology. *(Work at Avera Marshall Regional Medical Center, Marshall, MN)*

Laura Christensen (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology.

Julie Bender Crick (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology. *(Work at Sanford Health)*

Alycia Krcil (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology. *(Work at Sanford Health)*

Rosemary Price (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry. *(Work at Avera St. Luke's, Aberdeen, SD)*

Tanisha Sealey (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology. *(Work at Cambridge Medical Center, Cambridge, MN)*

Amanda Settje (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology.

Brandi Schollermann (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology.

Nichole Taylor (B.S. CLS, May '09), Major in Clinical Laboratory Science, Minor in Chemistry and Biology.

New Research Center Will Find New Uses for Light

Chemists and biochemists in a new research center at SDSU will use light as a tool to deliver and evaluate new medical treatments for diseases and to explore similar innovations.

The new center at SDSU is called the 2010 Center for Biological Control and Analysis by Applied Photonics. Photonics is a discipline that deals with generating, controlling, detecting and using visible light. Called BCAAP for short, the Center will lean heavily on the expertise of chemists. "It brings together researchers, primarily in the areas of organic and biochemistry, to use light as one of the tools to either control biochemical processes, or to analyze biochemical processes," said professor Ron Utecht in SDSU's Department of Chemistry and Biochemistry, who directs the new center. But Utecht said they will very likely work with colleagues in other disciplines, both at SDSU and else-where, to carry out projects.

Jim Rice, head of the Department of Chemistry and Biochemistry, said the department has been investing all of its discretionary research spending over the past several years to put in place the people and physical infrastructure necessary for a successful center proposal.

"We have invested heavily in new faculty like Dr. Hoppe by providing competitive research laboratory start-up packages and developing instrumentation resources such as core mass spectrometry and NMR facilities that are critical to the success of a group like this, and chemical research in general at SDSU. We will continue to make these investments with the Center's new faculty hires. Many people don't realize that academic research faculty are really entrepreneurs and these investments can be considered a form of 'venture capital' provided by the department to help them develop. The returns that we hope to receive on these investments are large research grants like the 2010 BCAAP Center."

The state of South Dakota will funnel $4.3 million over the next five years to the center through its Council on Research & Commercialization. SDSU also must make a matching contribution of $500,000 to the project. Its share will be used to hire and support two new chemistry faculty members whose areas of specialization will complement the expertise of the center's other researchers.

Here's a look at what the researchers are already are doing:

Professor Ron Utecht's research interests include working with a light-activated material that could replace surgical stents for treating peripheral arterial disease. The idea is to use the material to remodel the tissue in a patient's arteries so that arteries remain open as the patient heals.

Professor Fathi Halaweish, who works with drug discovery, is evaluating a biologically active compound that can be administered through photoactive treatment. Light-activated techniques can make it a "smart" treatment that delivers the drug more accurately to where it is needed.

Assistant professor Youngjae You's research interests include working with photodynamic therapy, which uses visible light, a non-toxic chemical "sensitizer," and oxygen to target and damage cancer cells while leaving healthy tissues unharmed. One focus of Dr. You's work is finding new photosensitizers to improve the treatment.

Assistant professor Adam Hoppe uses light to study the biochemical mechanisms that control cell function, particularly within the cells of the immune system. Specifically, his lab develops new methods based on what is called Fluorescence Resonance Energy Transfer to monitor changes within cells. That can include exploring how cells respond to medical treatments, thus generating crucial knowledge to help scientists fine-tune new drugs or therapies.

The two new faculty members SDSU will recruit will likely include a biochemist specializing in cell function and enzyme structure; and a specialist in computational chemistry who can use computer modeling techniques for biomedical uses.

Utecht said the intent is for the center to become self-sustaining after five years as its scientists, by pooling their expertise, begin to draw in more research funding from government and perhaps from industry supported by an increased professional stature of the BCAAP group.

If any of the center's projects lead to commercial products, Utecht added, there is a strong possibility that any new manufacturing jobs that result would be based in South Dakota.

Tanaka Undergraduate Award

Elizabeth Bosworth is working in Dr. Halaweish's lab on a project entitled "Study of hypericin as a potential photodynamic therapeutic agent." She will study the isolation and design organic synthesis for coupling hypericin and an organo-metallic complex, that can be safely administered in vivo and concentrated into target tissues for Photodynamic Therapy treatment. She will also gain familiarity with chromatographic and spectroscopic techniques and organic reactions. Completion date is the end of the Fall 2009 semester.

Scholarships and Award Winners

University and College Recognition

Schultz-Werth Awards for Undergraduate Creativity and Research: Mitchell Dobberpuhl and Christopher Johnson

Departmental Awards

CRC Press Chemistry Achievement Award: Lucas Zimney, Amanda Heeren, and Laura Sanborn

Phi Lambda Upsilon Award for Achievement in Organic Chemistry: Abbi Davelaar

Analytical Chemistry Award: Brian Eckrich

Merck Index Award: Kathryn Engle

American Chemical Society–Certified Graduates: Kathryn Engle and Christopher Johnson

Hypercube Scholar: Brian Eckrich

Dobberstein Research Award: Christopher Johnson

Sioux Valley Outstanding Senior Award: Christopher Johnson.

Sioux Valley Distinguished Senior Award: Derek Brandis, Catherine Coursen, Mitchell Dobberpuhl, Kathryn Engle, Ellen Hansen, Kalli Odegaard, Laura Sanborn, and Lucas Zimney

Departmental Scholarships

Eugene Burr and Ella Burr Schultz Scholarships: Travis Jordan

Elmer and Roberta Johnson Leaders of Tomorrow: Tanya Baldwin (incoming major) and Caitlin Forman (incoming major), Amy Rieck (returning student) and Elizabeth Bosworth (returning student).

Olive Burke Crary and Gerald D. Crary Jr. Scholarship: Alexis Schildauer

Hardin-Palmer Scholarship: Allison Henning

Herbert H. Hodgeson Award: Hillary Beldin

Webster-Klug Award: Bradley Anderson

Arthur W. Dobberstein Achievement Award: Abbi Davelaar and Melissa Lax

Donald E. McRoberts Award: Colleen Smith

Hach Scientific Foundation Scholarship: Samantha Loutsch

Guss Memorial Award: Jaclyn Nielsen, Hillary Beldin, and Alex Bohlman

Oscar and Elaine Olson Scholarship: Mitchell Perrizo

Lloyd Baille/Atlantic Richfield Award: Kristen Carlson

E. R. Binnewies Memorial Award: Jennifer Chase

Henry and Annrita Scholarship: Noah Bohlmann and Larissa Knutson

Joseph and Coral Bonnemann Scholarships in Medical Technology: Kevin McGuire

Louise Guild Scholarship in Biochemistry: Nichole Hartman

Philip and Eleanore Haskett Award: Jessica Goerdt (awarded in Fall 2008)

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